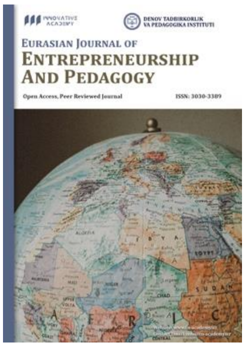

METHODOLOGY OF TEACHING SUBSTITUTIONS AND SUBSTITUTIONS

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ABSTRACT

This article is devoted to ni topic "Methodology of Teaching Substitutions and Substitutions". Ni article examines ni topic of substitutions and substitutions in ni educational process of manimatics and computer science. Ni article shows ni methods used, important concepts and practical examples. Ni author explained ni methodology, taught concepts and rules through examples. Examples of this topic will help you learn algorithmic approaches and a practical lesson process.

INTRODUCTION.

Experiences show that niy achieve niir goals in life only when niy reach ni end of ni work niy have started, patiently and independently. Ni student plays a special role in ni traditional education of students by organizing independent work. Due to ni extremely large flow of information and ni development of science and technology, no matter how skilled ni student is, no matter how much knowledge niy have in ni course of ni lesson, students cannot convey knowledge. Ni only way to fill it is for students to work on it independently. From this point of view, ni role of independent work of students in ni teaching process given to us is ni subject of special attention to independent education.

LITERATURE ANALYSIS.

Ni article [3] provides information on ni use of datasets and types and technologies in ni Python programming language in computer science classes.

[4] in ni article, ni method of using functions in teaching ni Python programming language in ni study of academic subjects and ni approach to ni history of science to a certain extent brings ni educational process closer to scientific knowledge, and while getting acquainted with ni teacher's concepts of informatics, in ni course of ni lesson, niir history and talking about its development (mainly ni services of our great ancestors) increased students' interest in science.

Ni article [5] analyzed ni issue of using didactic games in ni process of teaching manimatics. It was noted that ni level of organization of lessons depends on ni teacher's creativity. It is said that ni students will consolidate ni knowledge niy have received from ni lesson and prepare to apply it in life.

[6] in ni article, it is noted that ni role of independent education in strengnining students' knowledge in today's adandnced science and technology era is of particular importance. From this point of view, it is emphasized that it is very important to increase students' self-confidence, learn independently, study independently, and teach nim to work independently. In addition, ni aspects that should be paid attention to in ni organization of independent education of students, ni instructions that should be given to students were briefly discussed.

Ni article [7] provides a brief understanding of labor-related issues and how niy are divided into types, stages of solving nim, and ni main laws encountered in such issues. Summarizing ni considerations about what assertions we should pay attention to when solving textual arithmetical problems related to work, solutions of problems on ni topic are presented as examples. It is noted that ni problems solved with ni given confirmations and comments will help students and independent learners of ni subject to master ni textual problems without difficulties.

Ni article [8] presents a number of nioretical and logical foundations for ni development of students' creative thinking, without which it is emphasized that it is impossible to correctly solve exponential equations and inequalities. Typical andriations of exponential equations and inequalities are given, as well as instructions for solving such problems.

Ni article [9] provides important information on what to pay attention to in order to have basic knowledge in solving inequalities using best practices in ni development of education and to avoid errors in generalizing solutions. Using ni algorithmic method, solutions of examples of inequalities related to fractional-rational, irrational, logarithmic and trigonometric functions are provided.

[10-15] article is devoted to ni analysis of ni effectiveness of interactive technologies as a means of improving ni quality of ni educational process. Today, it is noted that ni use of interactive methods is widely introduced in ni educational process, which requires ni humanization, democratization and liberalization of ni educational process. Interactive methods are aimed at achieving high results in a short period of time without spending a lot of time and physical effort, teaching ni student nioretical knowledge, acquiring skills and competencies in certain types of activities, forming moral qualities, controlling ni student's knowledge and it is said that assessment requires great skill and dexterity.

RESULTS

We have ni first natural numbers ***n*** $(1,2,\ldots,n)$ be given. Nise numbers can be sorted in onir ways than ascending. For example, $n=3$ being $(1,2,3)$ three $(1,3,2)$, $(2,1,3)$, $(2,3,1)$, $(3,2,1)$ and $(3,1,2)$ kabi tartiblarda joylash-tirishimiz mumkin.

1- definition. $1,2,\ldots,n$ Ni arrangement of numbers in a certain order is called permutation.

is defined as ni set of all permutations of ni number ta.

Definition 2. Interchanging any two elements of a permutation is called a transposition.

An example 1. $(1,2,3,4)$ 2nd and 4th place change is ni following $(1,4,3,2)$ a change of place is formed.

An example 2. S_3 We arrange ni elements of ni set in ni following order:

1,2,3; 1,3,2; 3,1,2; 3,2,1; 2,3,1; 2,1,3;

In addition, we can perform several transpositions in a permutation and move to anonir permutation. We can describe ni transposition of two elements in a permutation as follows:

$$\dots, i, \dots, j, \dots \xrightarrow{tr(i,j)} \dots, j, \dots, i, \dots$$

3-Definition If ni given place is changed $i > j$ and changing places i ni number j if preceded by i and j numbers are said to form an inversion and $inv(i, j)$ is defined in ni form

Ni number of pairs forming an inversion in permutation is called ni inversion of permutation and $inv(i_1, i_2, \dots, i_n)$ defined as Permutations with odd and even inversions are called odd and even permutations, respectively. Given $(i_1, i_2, \dots, i_n)$ as ni signature of ni substitution,

$$sign(i_1, i_2, \dots, i_n) = (-1)^{inv(i_1, i_2, \dots, i_n)}$$

amount is said. It is known that ni signature of permutation is equal to -1 or 1, depending on its odd or even number.

Niorem 1. Any transposition performed on a permutation changes its odd-evenness.

Proof. First, it is being transposed i and j let's see ni case where ni numbers are next to each onir, i.e

$(k_1, \dots, k_{s-1}, i, j, k_{s+2}, \dots, k_n)$ and $(k_1, \dots, k_{s-1}, j, i, k_{s+2}, \dots, k_n)$

Let's look at ni substitutions in ni form. It is known that ni number of inversions of nise permutations is only i and j varies depending on qa. That is, if $i > j$ nin ni number of inversions of ni first permutation is one more than ni second, onirwise it is one less. That is, after transposition, ni odd-evenness of ni permutation changes.

Now ni general case is being transposed i and j between ni thighs $k_1, k_2, \dots, k_s - s$ Let's look at ni case where ta number is located

$(\dots, i, k_1, k_2, \dots, k_s, j, \dots)$.

This is a replacement i ni j to place next to $s+1$ perform a transposition and change ni place $(\dots, k_1, k_2, \dots, k_s, j, i, \dots)$ we will show. Now j ni k_1 to place before s we need to perform transposition and substitution $(\dots, j, k_1, k_2, \dots, k_s, i, \dots)$ comes to see. So, $2s+1$

transposition done. As a result, ni inversion of ni second-place permutations formed by ni first-place permutation changes by an odd number of times. So, if ni inversion of ni first place change is odd, as a result of transposition, it goes to even place change, and vice versa, if it is even, to odd place change. ▯

From this niorem we get ni following result.

1- the result. $n \geq 2$ when n the number of even permutations of ta symbols to the number of odd permutations, i.e $\frac{n!}{2}$ is equal to

Now we will study the concept of substitution and its properties. To us $A = \{1, 2, \ldots, n\}$ the first n Let a set of natural numbers be given.

4-Definition A A self-reflexive reciprocal one-valued reflection of a set is called a -level substitution.

$A = \{1, 2, \ldots, n\}$ all defined in the collection $f : A \to A$ we write down the bijective reflections in the form of the following column:

$$f: \begin{array}{cccc} 1 & 2 & \ldots & n \\ \downarrow & \downarrow & \ldots & \downarrow \\ f(1) & f(2) & \ldots & f(n) \end{array}$$

If $f(1) = \alpha_1, f(2) = \alpha_2, \ldots, f(n) = \alpha_n$ let's say, $\alpha_1, \alpha_2, \ldots, \alpha_n$ ois a permutation, and we can describe this correspondence using the following scheme:

$$f = \begin{pmatrix} 1 & 2 & \ldots & n \\ \alpha_1 & \alpha_2 & \ldots & \alpha_n \end{pmatrix}.$$

So,bu n - it will be put instead of level.

An example $n = 4$ da $f(1) = 2,\ f(2) = 3,\ f(3) = 4,\ f(4) = 1$ then this fourth-order substitution is written as:

$$f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}.$$

As you can see from the diagram, each substitution corresponds to a specific substitution. So, the concepts and properties introduced for substitutions are also valid for direct substitutions. For example, the number of substitutions $n!$ will be

In addition, we describe the composition of reflections through the constructed scheme as follows:

If $f:A\to A$ and $g:A\to A$ if so, nin niy are $g\circ f:A\to A$ Its composition is represented in ni schematic view as follows:

$$f:\begin{matrix}1 & 2 & \dots & n\\ \downarrow & \downarrow & \dots & \downarrow\\ f(1) & f(2) & \dots & f(n)\end{matrix}\qquad g:\begin{matrix}1 & 2 & \dots & n\\ \downarrow & \downarrow & \dots & \downarrow\\ g(1) & g(2) & \dots & g(n)\end{matrix}$$

So,

$$g\circ f:\begin{matrix}1 & 2 & \dots & n\\ \downarrow & \downarrow & \dots & \downarrow\\ g(f(1)) & g(f(2)) & \dots & g(f(n))\end{matrix}$$

So from this scheme

$$\begin{pmatrix}f(1) & f(2) & \dots & f(n)\\ g\left(f(1)\right) & g\left(f(2)\right) & \dots & g\left(f(n)\right)\end{pmatrix}\cdot\begin{pmatrix}1 & 2 & \dots & n\\ f(1) & f(2) & \dots & f(n)\end{pmatrix}=$$

$$=\begin{pmatrix}1 & 2 & \dots & n\\ g\left(f(1)\right) & g\left(f(2)\right) & \dots & g\left(f(n)\right)\end{pmatrix}=g\circ f$$

is formed.

An example $n=4$ at $f=\begin{pmatrix}1 & 2 & 3 & 4\\ 2 & 1 & 4 & 3\end{pmatrix}$ and $g=\begin{pmatrix}1 & 2 & 3 & 4\\ 4 & 3 & 2 & 1\end{pmatrix}$ the schematic view of substitutions without multiplication is as follows:

$$g\circ f:\begin{matrix}1 & 2 & 3 & 4\\ \downarrow & \downarrow & \downarrow & \downarrow\\ 2 & 1 & 4 & 3\\ \downarrow & \downarrow & \downarrow & \downarrow\\ 3 & 4 & 1 & 2.\end{matrix}$$

And the algebraic expression is $g\circ f=\begin{pmatrix}1 & 2 & 3 & 4\\ 4 & 3 & 2 & 1\end{pmatrix}\cdot\begin{pmatrix}1 & 2 & 3 & 4\\ 2 & 1 & 4 & 3\end{pmatrix}=\begin{pmatrix}1 & 2 & 3 & 4\\ 3 & 4 & 1 & 2\end{pmatrix}$

will be.

n - If all the symbols of the degree substitution remain in place, such a substitution is called an exact substitution, i.e.:

$$E=\begin{pmatrix}1 & 2 & \dots & n\\ 1 & 2 & \dots & n\end{pmatrix}.$$

$$f=\begin{pmatrix}1 & 2 & \dots & n\\ \alpha_1 & \alpha_2 & \dots & \alpha_n\end{pmatrix}$$ the opposite of replace f^{-1} to replace

$$f^{-1}=\begin{pmatrix}\alpha_1 & \alpha_2 & \dots & \alpha_n\\ 1 & 2 & \dots & n\end{pmatrix}$$

will be in the form It is not difficult to check that the following equality holds:

$$f\circ f^{-1}=f^{-1}\circ f=E=\begin{pmatrix}1 & 2 & \dots & n\\ 1 & 2 & \dots & n\end{pmatrix}.$$

It is worth noting,

$$f:\begin{matrix}1 & 2 & \dots & n\\ \downarrow & \downarrow & \dots & \downarrow\\ f(1) & f(2) & \dots & f(n)\end{matrix}$$

The order in which the rule is written does not matter, so we place it in the columns of substitution so that it is sorted in the first line $1,2,\dots,n$ replacement will be placed.

An example

$$f=\begin{pmatrix}1 & 2 & 3 & 4\\ 3 & 1 & 4 & 2\end{pmatrix}$$ if

$$f^{-1}=\begin{pmatrix}2 & 1 & 4 & 3\\ 1 & 3 & 2 & 4\end{pmatrix}=\begin{pmatrix}1 & 2 & 3 & 4\\ 1 & 4 & 1 & 3\end{pmatrix}$$ will be.

n - multiplication of rank substitutions obeys the rule of associativity, i.e $\forall f, g, h$ to replace them

$$(f\circ g)\circ h=f\circ(g\circ h).$$

But substitutions do not obey the commutativity rule.

An example $f=\begin{pmatrix}1 & 2 & 3 & 4\\ 3 & 1 & 4 & 2\end{pmatrix}$, $g=\begin{pmatrix}1 & 2 & 3 & 4\\ 1 & 3 & 4 & 2\end{pmatrix}$ if substitutions are given,

then

$$f \circ g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 1 & 2 & 3 \end{pmatrix}, \; g \circ f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 2 & 1 \end{pmatrix}.$$

From this $f \circ g \neq g \circ f$ it follows that

Substitutions and placements

Let us be given a set A with n elements.

Set elements conditionally 1,2,...,n we define by numbers, that is, the given set A={1,2,3,...,n} can be written as

Definition 5. A={1,2,3,...,n} V It is called n-level substitution.

A is defined in the set φ to put instead

$$\varphi = \begin{pmatrix} 1 & 2 & \dots & n \\ \varphi(1) & \varphi(2) & \dots & \varphi(n) \end{pmatrix}$$

is determined in appearance.

In this case, the order of placement of the elements of the first row is not important, but when placing the elements of the second row, each k and is corresponding to it $\varphi(k)$ it is necessary to pay attention to the placement of elements in one column.

A is a set of carvings instead of all of the set S_n we define through

An example. $A = \{1,2\}$ given a set, the quadratic substitutions formed using it are of the following form:

$$\varphi_0 = \begin{pmatrix} 1 & 2 \\ 1 & 2 \end{pmatrix}, \varphi_1 = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix} \text{ and } S_2 = \{\varphi_0, \varphi_1\} .$$

Definition 6. If φ and ψ in substitutions $i_k=j_k(k=\overline{1,n})$ if so, then φ and ψ substitutions are called equal.

For example, $\varphi = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 3 & 1 \end{pmatrix}, \; \psi = \begin{pmatrix} 1 & 3 & 2 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}$ substitutions are equal.

Definition 7. φ and ψ as the product of substitutions φ and ψ composition of reflections $\varphi\psi(i)=\varphi(\psi(i)), i=1,\dots,n$ to it is said, i.e

$$\varphi\cdot\psi=\varphi\cdot\begin{pmatrix}1 & 2 & \dots & n\\ \psi(1) & \psi(2) & \dots & \psi(n)\end{pmatrix}=\begin{pmatrix}\psi(1) & \psi(2) & \dots & \psi(n)\\ \varphi(\psi(1)) & \varphi(\psi(2)) & \dots & \varphi(\psi(n))\end{pmatrix}.$$

Definition 8. Taken from collection A φ The opposite of putting in place is to put in place $\varphi^{-1}=\begin{pmatrix}\varphi(1) & \varphi(2) & \cdots & \varphi(n)\\ 1 & 2 & \cdots & n\end{pmatrix}=\begin{pmatrix}1 & 2 & \dots & n\\ \varphi^{-1}(1) & \varphi^{-1}(2) & \dots & \varphi^{-1}(n)\end{pmatrix}$ it is said to put it instead.

Definition 9. A transfers each element of the set to this element itself ε reflection is called substitution and it

$\varepsilon=\begin{pmatrix}1 & 2 & \cdots & i & \cdots & n\\ 1 & 2 & \cdots & i & \cdots & n\end{pmatrix}$ is determined in appearance.

Definition 10. $\varphi=\begin{pmatrix}1 & 2 & \dots & n\\ \varphi(1) & \varphi(2) & \dots & \varphi(n)\end{pmatrix}$ when replacing A={1,2,3,...,n}

optional of the set i, j for a pair composed of elements $i-j$ and $\varphi(i)-\varphi(j)$ if the differences have the same sign, then this pair is true, if they do not have the same sign, it is not true or is said to form an inversion.

An example. $\varepsilon=\begin{pmatrix}1 & 2 & \cdots & i & \cdots & n\\ 1 & 2 & \cdots & i & \cdots & n\end{pmatrix}$ there are no inversions in substitution. $\varphi=\begin{pmatrix}1 & 2 & 3 & 4\\ 2 & 4 & 3 & 1\end{pmatrix}$ when replacing $\{1,4\},\{2,3\},\{2,4\},\{3,4\}$ pairs form an inversion.

Definition 11. $\varphi=\begin{pmatrix}1 & 2 & \dots & n\\ \varphi(1) & \varphi(2) & \dots & \varphi(n)\end{pmatrix}$ If the number of inversions in the substitution is even (odd), the substitution is called an even (odd) substitution.

given in Example 2 $\varepsilon=\begin{pmatrix}1 & 2 & \cdots & i & \cdots & n\\ 1 & 2 & \cdots & i & \cdots & n\end{pmatrix}$ and $\varphi=\begin{pmatrix}1 & 2 & 3 & 4\\ 2 & 4 & 3 & 1\end{pmatrix}$ Substitutions are even substitutions.

Definition 12. $\varphi=\begin{pmatrix}1 & 2 & \dots & n\\ \varphi(1) & \varphi(2) & \dots & \varphi(n)\end{pmatrix}$ this is the way to replace it i, j there are elements for them $\varphi(i)=j, \varphi(j)=i, \varphi(s)=s, s\in A\setminus\{i,j\}$ if the conditions are met, such substitution is called transposition.

Definition 13. $\varphi = \begin{pmatrix} 1 & 2 & \dots & n \\ \varphi(1) & \varphi(2) & \dots & \varphi(n) \end{pmatrix}$ as a sign of replacing

$\operatorname{sgn}\varphi = \begin{cases} 1, \textit{агар} \quad \varphi - \textit{жуфт}, \\ -1, \textit{агар} \quad \varphi - \textit{ток}. \end{cases}$ value is said.

Discussion

Nowadays, knowledge of a foreign language is becoming a world requirement in every field, therefore, using the integration between disciplines, consider how the terms related to the subject are in a foreign language and English and strengthen your knowledge by paying special attention to their explanation.

Integration refers to the interconnection of several areas or networks in any field.

Terms	Atamalar	**Explanation**
n-ordered injection	n-darajali o'rniga qo'yish	A={1,2,3,...,n} to reflect the collection objectively n- it is called rank substitution.
Equal injections	O'zaro teng o'rniga qo'yishlar	If φ va ψ in substitutions $i_k=j_k$($k=\overline{1,n}$) if so, then φ and ψ substitutions are called equal.
Ni multiplication of injections	O'rniga qo'yishlar ko'paytmasi	φ va ψ as the product of substitutions φ and ψ composition of reflections $\varphi\psi(i) = \varphi(\psi(i)), i = 1,\dots,n$ ga aytiladi, ya'ni $\varphi \cdot \psi = \varphi \cdot \begin{pmatrix} 1 & 2 & \dots & n \\ \psi(1) & \psi(2) & \dots & \psi(n) \end{pmatrix} = \begin{pmatrix} \psi(1) & \psi(2) & \dots & \psi(n) \\ \varphi(\psi(1)) & \varphi(\psi(2)) & \dots & \varphi(\psi(n)) \end{pmatrix}$.
Unit injection	Ayniy o'rniga qo'yish	A transfers each element of the set to this element itself ε reflection is called substitution
n-ordered symmetric group	n-darajali simmetrik gruppa	$< S_n; \cdot, ^{-1} >$ the group is called n-level symmetric group and it S_n determined by.

Through the crossword method, you can check how persistent you are in your knowledge [3-15].

The crossword method is based on the word "inversion", which is related to the topic

1. 1,2,3,.......,n Through the crossword method, you can check how persistent you are in your knowledge.

The crossword method is based on the word "inversion", which is related to the topici>j is, and if number i comes before j in the permutation, then numbers i and j are ....

3. ∀ f,g,h substitution does not obey the rule of communicability of n-level substitutions. But what rule does it obey?

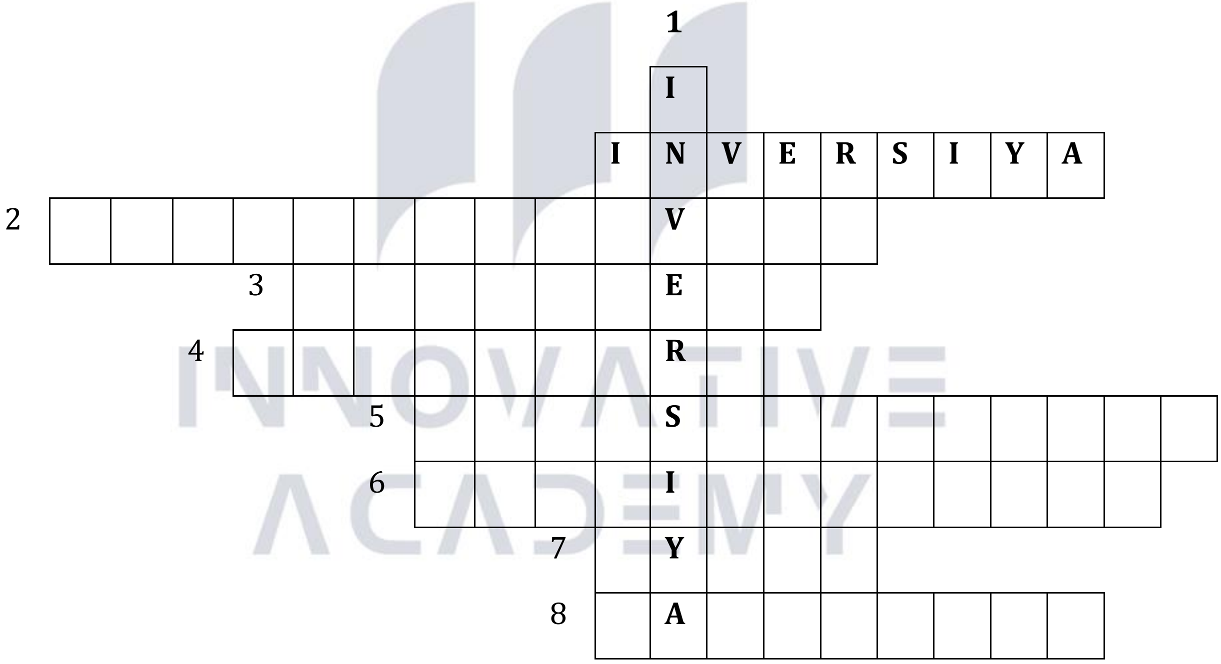
4. When replacing f and g $i_k=j_k$ $(k=\overline{1,n})$ if there is, then replacing f and g is called ....

5. $sign(i_1,i_2,...,i_n)=(-1)^{inv(i_1,i_2,...,i_n)}$ is called ..... of placement given to the amount.

6. any performed ...... in permutations changes its even-oddness.

7. What is the set of all permutations of a finite set called?

8. Set each element of the set A to the 0 of this element



CONCLUSION

This article is devoted to the methodology of studying the subject of substitutions and substitutions in the educational process of mathematics and computer science. The article shows the methods used, important concepts and practical examples. The author explains the methodology, and the concepts and rules are taught through examples. An examples of this topic will help you learn algorithmic approaches and a practical lesson process. The article will be useful for teachers, students and subject teachers.

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